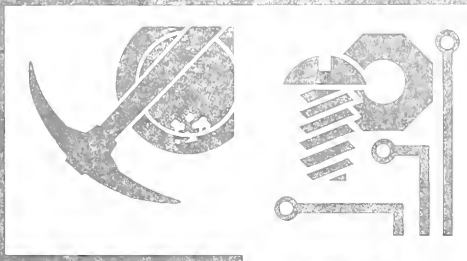
Annual Report
and
Recommendations to the Gover



submitted
by

The Governor's Council of Economic Advisors

1980

The Governor's Council of Economic Advisors

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August 29, 1980

The Honorable Thomas L. Judge
Governor, State of Montana
State Capitol
Helena, MT 59601

Dear Governor Judge:

Transmitted herewith is the second annual report of the Council of Economic Advisors. This fulfills the mandate of Executive Order 19-77 directing the Council to submit to the Governor an annual report of its activities during the preceding year and recommendations as to how state government can best serve Montana's private economy.

This year the Council selected for primary emphasis the impact of energy on Montana's private economy. The Report assesses these energy impacts in terms both of cost and availability and makes recommendations for state government to consider in dealing with them.

In the course of its work the Council traveled to Colstrip and to Decker, Montana to view the present state of coal development and the potential for coal as a source of Montana's future energy needs. Additionally the Council conducted visits to the Montana Energy and MHD Research Center and the National Center for Appropriate Technology in Butte. These visits were valuable in acquainting the Council with activities underway with respect to the development of alternative energy and coal conversion technologies. The Council also continued to discharge its responsibilities with respect to the Montana Small Business Program.

As you know the Council also frequently met with you and during these meetings you briefed us on activities in which state government is involved in support of Montana's private economy.

We hope you find our year's work and this report useful.

Very truly yours,

Ross W. Cannon
Chairman

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Introduction

This report focuses on the effect on the Montana economy of trends in energy, transportation, and international trade. Events in 1979 leave little doubt concerning the importance of these subjects. The revolution in Iran resulted in the disruption of petroleum supplies in the United States, including Montana. The OPEC nations implemented major increases in the price of oil that exceeded all reasonable projections for such prices at the beginning of the year. In the area of transportation, Montana has been threatened with the loss of most of the services of the Milwaukee Road because of the bankruptcy of that firm, and one AMTRAK line was discontinued. Changes in air service—the consequence of airline deregulation—became more frequent in Montana. 1979 also saw the continued increase in emphasis in Montana and the rest of the nation on the expansion of international exports.

The events and trends in energy, transportation, and international trade are not only important, but also are related to each other. The rising cost of energy and intermittent restrictions in its supply affect the cost and availability of different forms of transportation and the cost of production in agriculture and industry. The cost and availability of transportation, in turn, affects the ability of Montana to engage in beneficial international trade. Being able to produce and transport products for export on a competitive basis is important to both Montana and the nation to help finance, among other items, the imports of oil and natural gas from other nations.

The special relationship between agricultural exports and energy imports was highlighted at the beginning of 1980 when the United States embargoed 17 million tons of grain exports to the Soviet Union in retaliation for Soviet military intervention in Afghanistan. To counteract the reduction caused by the embargo of both farm income and the ability of the United States to import oil, the President announced proposals to expand substantially the production of alcohol fuels for grain.

The topics of energy, transportation, and international trade underscore the importance of the relationship between Montana and the rest of the world. If Montana is to be a partner with the rest of the world, it is necessary for the state to deal with the world from a position of strength. Such a position of strength requires that the state's private economy be competitive and innovative on a sustained basis. It requires, also, effective governmental policies and efforts to advance the interests of Montana as defined by its citizens.

Goals for Montana's Economy

In its first report, this Council recommended a value perspective and set of goals to guide economic policy in the state. Both the perspective and the goals continue to be relevant to the making of state policy, and the Council recommends them for continued consideration. These goals provide a useful framework for evaluating the trends and formulating recommendations concerning the issues addressed in this report.

Employment

1. To provide meaningful employment for every Montana resident desiring work.
2. To increase or change the diversity of work opportunities within the framework of values discussed in the Council's first report.
3. To increase the diversity of employment arrangements.

Income

1. To provide a satisfactory level of per capita income for all Montanans.
2. To increase the proportion of the profits from Montana economic activities which are returned to Montanans.

Sustainability and Renewability

1. To minimize the unfavorable environmental impacts of economic activities.
2. To conserve all resources by increasing the efficiency with which they are used.
3. To promote and stabilize those economic activities such as agriculture and timbering that are based on a sustainable renewable resource.
4. To encourage the long-term sustained production of the mineral industry within the framework of Montana reclamation and mining laws.

Diversity

1. To increase the diversity of Montana's economic base within the framework of values discussed in the Council's first report.
2. To encourage greater processing of Montana's raw materials in Montana to provide more jobs for Montanans.
3. To encourage the manufacture in Montana of products now being imported.
4. To promote more even geographic distribution of economic activity.

Control

1. To increase the extent to which economic decisions affecting Montana are made by Montanans.
2. To increase citizen participation in Montana's economic decision making.
3. To streamline bureaucratic procedure as it relates to business and economic development.

Other

1. To promote community independence and stability.
2. To be concerned about the rise in the cost of basic necessities.
3. To increase public awareness and understanding of Montana's economy.
4. To educate Montanans as to the benefits and costs of economic development in order to improve the quality of public decisions concerning the expansion of economic activity.
5. To develop effective procedures for planning as an integral part of present and future economic policy.

Energy and the Montana Economy

Predicting future energy trends that will affect Montana is a difficult if not impossible task. The forces that shape these trends are often beyond the control of the state and even the nation and are inherently unpredictable. Beyond the prediction that certain forms of energy—especially petroleum products—will be increasingly scarce and expensive, there is little that can be predicted with reasonable certainty. The best that can be done is to study the details of what has occurred and to make the best judgments possible of what might occur in the future.

Even understanding what has occurred with respect to energy **in economic terms** is very difficult. There appears to be no uniform and reliable data on the cost of energy broken down by Montana's economic sectors. Most of the information that is available is stated not in dollar terms, but in terms of BTUs or physical units—barrels of oil or kilowatts of electricity, for example. Even these statistics are incomplete because of the absence of information on the use of renewable-energy resources at the state level. The use of renewable energy is expanding and historically has been substantial in the wood products industry.

It had been the intent of the Council to present an analysis of energy in the Montana economy based on what one Council member termed an "energy quotient" for each sector. An energy quotient would measure the portion of the total costs of production represented by energy costs. The absence of appropriate information makes it impossible to present such quotients for the Montana state economy.

An approximate idea of the relative energy intensity of different economic sectors can be secured, however, through the use of national data computed by University of Illinois researchers. This information estimates the amount of BTUs of energy used per dollar value of output in different sectors.[1] Energy used in a given sector includes not only the energy used directly, but also the indirect energy embodied in the goods and services used by that sector to produce its products. This means, for example, that for raising grain the measure of energy use includes not only the fuel to power a tractor, but also the energy that was used to produce that same tractor. In other words, this information attempts to present a picture of the complete degree of dependence on conventional energy sources for different economic sectors.

Some major limitations of this data should be understood. It is national data for broad economic sectors, and production in Montana may vary from the national norm. For example, grain production is treated as one economic sector, combining Midwestern corn with Great Plains wheat. Raising dryland wheat in Montana is considerably less energy intensive than raising corn in Illinois. Secondly, the data reflect methods of production that were used in 1967 and that may have changed significantly since then. Finally, renewable energy sources such as wood or solar energy are not included in the data. The numbers given are for BTUs per dollar of output, with the BTUs derived from what the researchers have termed "primary energy." "Primary energy" refers to conventional, raw sources of energy: coal, crude oil, and natural gas, and electricity from hydropower and nuclear sources.

Despite these qualifications, the data still provide a useful approximation of the relative energy dependence of different economic sectors. Out of the 357 national sectors, 16 were selected because of their importance to the primary economic base of Montana. These sectors were classified as follows into categories of high, medium, and low energy intensity:

High Energy Intensity—200,000 BTUs/$ output and up

Primary Aluminum Processing	387,646
Paper Mills	201,228
Pulp Mills	200,511

Medium Energy Intensity—100,000 to 199,999 BTUs/$ output

Primary Copper Processing	139,706
Copper Mining	130,650
Nonferrous Mining (excludes coal)	128,209
Primary Lead Processing	110,162

Low Energy Intensity—0 to 99,000 BTUs/$ output

Farm Machinery	71,846
Wood Products	71,609
Grain Production	68,632
Veneer Plywood	67,942
Meat Packing	67,722
Sawmills	65,607
Forestry & Fishery Products	65,553
Logging	54,710
Millwork	47,599

[1] **Robert A. Herendeen and Clark W. Bullard III, "Energy Costs of Goods and Services, 1963 and 1967," University of Illinois at Urbana-Champaign, November, 1974.**

A general expectation created by this data is that the high energy intensity industries are likely to be more heavily affected by rising energy prices and energy shortages than low energy intensity industries. Such may indeed be the case. However, care should be taken in making such an interpretation because, as in the case of agriculture, the timing and type of energy being used may be as important to the production process as the amount of energy. Market conditions need to be taken into account as well. An industry that is able to pass cost increases on in the form of higher prices may be less affected by energy costs than industries that cannot readily transfer their cost increases. Some of these factors will be considered in discussing individual portions of the Montana economy.

Turning to the overall energy picture in Montana, the state produces about two and a half times the energy it consumes. In the mid and late '70s, about 60 percent of the fossil fuel and electrical energy produced in Montana was attributable to coal—and over 90 percent of this energy was exported from the state. Crude oil has represented about 25 percent of the state's energy production in recent years, and the large majority of this oil (73 percent in 1978) has been exported. Hydroelectric power and natural gas are the other major conventional sources of energy produced in the state. Data on renewable energy production—wood and solar power, for example—are not available, with the exception of hydroelectric power.

Despite much greater production than consumption, Montana has encountered shortages of petroleum products and electricity at various times in the 1970s, and the potential exists for further shortages to occur. Paradoxically, Montana has been both energy rich and energy short at the same time. There are two basic reasons for this circumstance. First, the kinds of energy consumed in Montana are, in relative portions, different from those that are produced. Coal is the dominant fuel produced and petroleum products are the primary fuels consumed. Second, while Montana coal has at present a geographically limited market, crude oil and petroleum products move in an international network of distribution, and what is produced within Montana is not necessarily available for use here.

Of the energy consumed in Montana, about one-half in 1977 was used by industry, about 30 percent for transportation, and 20 percent for residential and commercial uses. Residential and commercial uses of energy have remained relatively constant during the past decade, while transportation use has increased moderately and industrial use has increased substantially.

Montana historically has been a state with low energy costs because of inexpensive hydropower and natural gas produced within the state. The Annual Survey of Manufacturers for 1976, published by the Department of Commerce, compared energy costs for states and indicated that Montana was the third lowest state in energy costs per million BTUs of purchased fuels and electricity. Montana costs were estimated to be about 60 percent of the national average at that time. It is likely that Montana will continue to be a relatively low-cost energy state, but the difference between Montana costs and average national costs is narrowing. Montana is relying increasingly on Canadian natural gas (the cost of which is linked to OPEC oil prices) and on electricity generated from coal. Costs for these sources of energy are more nearly equal to national cost levels than are the costs of hydropower and Montana natural gas.

Overall, the major energy problem confronting Montana in both the short- and long-term future is a high degree of dependence on petroleum products, most of which are imported. Nearly half of all energy consumption in recent years has been in the form of petroleum products. The overdependence on petroleum is, of course, the same general problem confronted by the entire nation. In Montana, the most readily available alternatives to petroleum are conservation, coal, and various renewable forms of energy. As Montana considers methods of both energy conservation and development, several concerns should be kept in focus. Any energy cost advantages that can be secured without sacrificing other important goals should be realized to benefit both economic production and household consumption in the state. Reliability in supplies should be ensured, with attention given to the potential for cost-efficient energy production in local areas. Overall, energy development and conservation should occur in a manner that support the broad-based goals recommended in this report.

To understand better the energy challenges and opportunities that confront Montana, the role of energy in major sectors of the Montana economy will be considered. Beneficial opportunities for energy conservation and development will also be identified.

Energy and Agriculture

Agriculture accounted for 4.4 percent of the state's energy consumption in 1974. This figure is slightly higher than the national share of energy used by agriculture. The reason for this is simply that Montana agriculture represents a much larger portion of the state's economy than U.S. agriculture represents of the national economy. Montana's major agricultural activities—cattle grazing and dryland wheat production—represent, in fact, two of the most energy-efficient forms of agriculture in the U.S. Of the energy used in agricultural production, the largest portion (about 45 percent) is energy used to produce synthetic fertilizers and pesticides. Field work and farm transport each account for slightly less than one-fourth of agricultural energy use. None of these statistics includes energy used for rural homes or for transporting agricultural products from local trade centers to their ultimate markets.

Overall, Montana agriculture uses a share of the state's energy that is much smaller than its share of the state's economy. This fact, however, can easily lead to a serious underestimate of the importance of energy to the state's agriculture. Petroleum products, fertilizers, and electricity play a key role in agricultural production—production that is timed and regulated by the seasons and weather. If energy supplies are not adequate at critical times—for example, at planting and harvest—the consequences can be disastrous.

The net income effect of a shortage of energy at a critical time of a season would be obviously negative. Less clear is the impact of rising energy prices on net farm income. If prices do not rise or cost savings do not occur through more efficient use of energy or other items of production, the impact of rising energy prices is clearly a decline in net farm income. But if price increases or cost savings occur to a sufficient degree, net agricultural income will not necessarily decline. It should be remembered also that Montana farmers compete in international markets, and maintaining net income depends, in part, on maintaining a competitive position. As the price of energy increases, efficiency in the use of energy or other items used for production becomes increasingly important to maintaining a competitive position. What this means in general is that because Montana farmers and ranchers cannot control the prices they receive, controlling the cost of energy through conservation or finding efficient substitutes is important to maintaining their net income.

Fortunately, prospects are improving that farmers may be able to secure valuable reserve supplies of energy or even efficient substitutes for petroleum products from renewable, agricultural or forest-product sources. Plants store solar energy that has been converted through photosynthesis, and this "bioenergy" can be tapped in a variety of ways. Grain, crop wastes, and wood products can be used to produce alcohol to be burned directly or mixed with gasoline or diesel fuel. Wood can be used directly or can be converted to a variety of fuel products. The use of wood will be discussed in the following section, "Energy and Forestry." Of concern here are the uses that can be made of the products of farms and ranches.

A debate has proceeded among experts over the economic feasibility of fuel alcohol production from grain and crop residues. Studies that cast doubt on the economics of fuel alcohol from agricultural products generally have assumed a production process adapted from the beverage alcohol industry—a process that consumes

Agriculture accounted for 4.4 percent of the state's energy consumption in 1974. Montana's major agricultural activities—cattle grazing and dryland wheat production—are two of the most energy-efficient forms of agriculture in the U.S.

Photo by Rick Graetz.

relatively large amounts of energy to produce the alcohol. However, recent studies into improving the efficiency of alcohol production suggest that substantial improvements are being and can continue to be made through intensified research. For example, a technique developed at Purdue University may reduce by 90 percent the energy required to remove water in the final stage of the alcohol distillation process.[2] Reducing energy use in this stage of alcohol production is important because 50 to 80 percent of the energy use in current methods occurs at this final stage of dehydration. In the Purdue technique, cracked corn (other cellulose products also could be used) simply was dumped into the alcohol-water mixture. The corn absorbed the unwanted water, leaving a final alcohol product suitable for fuel use.

Montana state government is supporting alcohol fuel research and demonstration projects both through its alternative energy program and the wheat and barley research and marketing program. The production of alcohol from grain or wood wastes is being planned at several locations in the state. Legislation supporting research and production of alcohol fuels is currently pending in Congress as a part of synthetic fuel legislation. Substantial initiative within the agricultural community, the positive response of several state governments including Montana, the prospects for federal support of alcohol production, and the urgency of reducing American dependence on imported oil are likely to produce a major trend toward the use of alcohol fuels. Substantial emphasis is given in this report's energy policy recommendations to ways that Montana can encourage and benefit from this emerging trend.

It should be noted that the use of starch from grains for alcohol production does not eliminate their other food or feed values. The direct fermentation of grain yields a high-protein product called distillers dried grains. Alternatively, grains also can be preprocessed to remove the germ, bran, and gluten before the remaining starch is fermented into alcohol. Developing complementary uses of the valuable food and feed by-products of alcohol production from grains is an important economic issue to consider as alcohol fuel production emerges in Montana.

Increased efficiency or conservation in the use of energy in agriculture can occur through changes in tillage and cultural practices and through the substitution of natural for synthetic fertilizers. One potential energy-efficient change in Montana agriculture that also would yield other benefits is the substitution of forage production for summer fallow in dryland-wheat rotation systems. Besides net energy benefits, the increased use of forage also can help to alleviate saline seep problems.

A separate set of topics concerning energy and agriculture involves conflicts in resource use between agriculture and coal energy production. These conflicts have shaped much of the debate in the past decade about resource development in the state. Out of this debate has emerged legislation designed to provide Montanans with a choice in determining how to reconcile these resource conflicts:

A new water-rights appropriation and reservation process has been established.

Pollution-control laws and standards have been revised.

A strong reclamation law was enacted.

Community impact-assistance programs were adopted.

A major facility-siting process was established.

Together this legislation provides tools for assessing and minimizing adverse effects of major energy development on agriculture as well as other portions of Montana society. These instruments of public policy are likely to be viewed with increasing importance as the demand for Montana coal accelerates in the decades ahead. Further consideration is given to the effect of energy development in a later section of this report, "Montana Energy Industries."

[2] **Michael R. Ladisch and Karen Dyck, Science, August 31, 1979, pp. 898-900.**

Energy and Forestry

With the exception of pulp and paper mills and related paperboard production, the use of conventional energy sources in the forest industry is perhaps the lowest of all the primary industrial sectors in Montana. However, the forest industry also uses a substantial quantity of "bioenergy" in the form of wood and process residues. On a national basis, it is estimated that 1.3 quadrillion BTUs of bioenergy are used, and of that amount 1.1 quadrillion BTUs are utilized in the wood products industry. (For comparison purposes, it should be noted that the United States curently uses about 75 quadrillion BTUs of energy annually.)

The national potential for the use of wood products for energy has been estimated by the Senate Agriculture Committee to be an additional 9.6 quadrillion BTUs—more than 10 percent of the nation's energy usage.[3] This energy would come not from wood now used for other purposes, but from noncommercial timber, excess growth, logging residue, standing cull and dead timber, mill wastes, and wood from thinning. Estimates of the potential energy from these sources in Montana forests are not available, but it is reasonable to assume that the potential is substantial.

Wood is an extremely versatile energy source. It can be burned directly, or it can be pelletized by itself or with coal dust to form a standardized and marketable commodity. Wood can be processed into an alcohol product (methanol) or, through a process of heating in the absence of oxygen (pyrolysis), can be converted into a char, oil, or gas suitable for large energy users now consuming oil or natural gas. Because it is both renewable and convertible to a variety of forms, the potential for wood as a future energy source is substantial and should be given major consideration in Montana for both in-state and export purposes.

The national potential for the use of wood products for energy has been estimated by the Senate Agriculture Committee to be more than 10 percent of the nation's energy usage. Montana Chamber of Commerce photo.

With proper technology, wood can be burned cleanly. Unfortunately, most of the current wood-burning methods in common residential use produce substantial quantities of air pollution and contribute to poor winter air conditions in populated mountain valleys of western Montana. The development and utilization of cleaner wood-burning technology should be a major priority in expanding the use of this energy source.

Wood also is being used in Eugene, Oregon and Burlington, Vermont to generate electricity. The Eugene plant is a 33.8 megawatt steam-electic generation plant fueled with surplus forest residues. This plant also supplies steam-heat service to businesses, a hospital, a college campus, a cannery, and a 16-acre greenhouse complex. Burlington, Vermont uses culled timber that is chopped into chips to fire a 20-megawatt generating plant, and plans are being made to expand its capacity to 50 megawatts.

Those portions of the forest industry—paper and pulp mills—that do intensively use conventional sources of energy are confronted with the same challenge as other major industrial users of energy, namely to maintain a competitive market position through the more efficient use of increasingly expensive energy. As noted in the next section, that efficiency can be achieved through energy conservation, improved management, investment in more efficient technology, and the cogeneration of heat and electrical power. Thus, the discussion of energy and major manufacturing in Montana will apply equally as well to pulp and paper mills.

[3]**Senate Report 365, "Agricultural, Forestry, and Rural Energy Act of 1979," 96th Congress, 1st Session.**

Energy in Mining and Manufacturing

Many of the traditional manufacturing and mining activities in Montana are substantial-to-very-heavy users of energy. (Energy industries are not considered here, but in a later section.) As a general matter, metal mining and processing, pulp and paper mills, and chemical plants are the types of industry with the largest energy use in Montana. These are also the types of industry that provide a major portion of the jobs in the state that pay a higher than average wage. Overall, industry accounts for about one-half of the energy consumed in Montana. It also consumes about 60 percent of the electricity used in the state.

The impact of future energy supply and price conditions on the largest energy users in the industrial category will depend on the particular production and market conditions confronting each of the major plants in the state. Such matters as the status of the technology used by Montana industries, the market for their products, and the degree of competition that they confront either from competing plants or from substitute products all will tend to influence the impact of energy costs on Montana industries. In general, however, the greater the energy efficiency of Montana industries, the more likely they are to maintain competitive positions or to take the lead in earning profits within their respective industry groups.

Montanans have a dual stake in the efficient use of energy in major industrial facilities. If these facilities do not maintain a competitive position in their respective markets, the jobs that they provide to the state could be lost. Secondly, inefficient industrial use of energy can help prompt the development of costly, new energy facilities whose expense could be shared by all Montana consumers. Both the industries themselves and the citizens of Montana have an interest in achieving industrial energy efficiency.

As a general matter, metal mining and processing, pulp and paper mills and chemical plants are the types of industry with the largest energy use in Montana. Overall, industry accounts for about one-half of the energy consumed in Montana. It also consumes about 60 percent of the electricity used in the state.
Anaconda Co. photo.

Industrial efficiency can be achieved through better management of energy use, the recovery of waste energy primarily through the cogeneration of heat and power, and through technological innovation. Dow Chemical Company is noted for achieving a 40 percent reduction in energy use in the 1970s primarily through better management of its energy inputs and with little capital investment. The cogeneration of heat and power, while practiced in the United States, is less prevalent than in earlier decades of this century. Significant potential appears to exist to tap waste energy from industry for heating and electrical generation purposes. Surveys of the potential for cogeneration in Montana have been undertaken by the Bonneville Power Administration with cooperation from the state government and industrial plants. New technology often can lead to significant energy savings as well as other beneficial economic and environmental results. State efforts to expand international markets for Montana products and to attract research and development facilities to the state could help to foster a favorable environment for investment in technical change in Montana industries.

It should be understood that not all manufacturing enterprises in Montana are intensive energy users. Many of the specialty manufacturing firms that produce goods with a high value in relation to their weight also are relatively low intensity energy users. As noted in the earlier national data, such industries as meat packing and farm machinery have modest energy requirements. Montana has been increasingly attractive to firms of this general type, and much of the state's development effort has been aimed at encouraging their establishment or expansion.

Montana Energy Industries

The growth and diversification of Montana energy industries comprise a major portion of the economic history of Montana in the 1970s. Coal production grew dramatically and jumped from being the smallest portion of the state's energy production to its largest. Diversification also occurred in the latter part of the decade in the form of the growth of renewable energy production and the initiation of systematic conservation activities by citizens, government, business, and public utilities.

The rate of future growth of Montana coal production will depend on a variety of interational and national economic and public-policy trends as well as on conditions within the state. Such matters as the rate of conversion of oil-fired utilities to coal, the rate of development of coal-based synthetic fuels, the general growth in energy demand, national environmental standards concerning the use of coal, and the development of alternative sources of energy will be important factors affecting coal development from both inside and beyond the borders of Montana. Social, economic, and environmental conditions within the state, as well as intensifying conflict between consuming and producing states, will be additional factors affecting the development of coal-based energy.

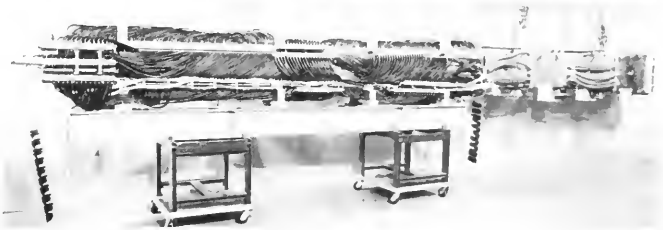
A May, 1979 study by Data Resources, Inc., a national economic consulting firm, projects that the Montana-Wyoming area will jump from fourth of six coal-production areas to first between 1980 and 1990 and will, by the turn of the century, produce one-third of the nation's coal supply.[4] These projections suggest that over 600 million tons of coal will be produced in Montana and Wyoming by the year 2000. These projections are, however, more than twice as high as those made by the Montana University Coal Demand Study Team. The team suggested that 200 to 300 million tons was the most likely level of production in the Northern Great Plains at the end of the century.[5] The difference between these projections suggests how difficult it is to predict the energy future for either Montana or the nation. In either case, however, a substantial increase in coal production is projected from the 1978 level of about 92 million tons produced in Montana and Wyoming.

As noted earlier, social and environmental effects and conflicts with other resource users, principally the agricultural community, were a major source of controversy concerning coal development in the past decade. The projected future growth of coal production is, if anything, likely to intensify the same kinds of concerns. The general supply of water in eastern Montana appears to be adequate to satisfy competing uses. Nevertheless, water may not be sufficient in particular locations, and controversy will exist concerning both the competing uses in those places and any proposed storage and distribution facilities designed to satisfy expanding water demands. Community impact and land-reclamation issues will be topics of continuing concern.

The above concerns will require continuing research into the effects of coal development and into proper methods of alleviating any adverse effects. Many of the concerns will need to be resolved through wise decisions concerning coal development within the framework of Montana law. Such decisions also should take account of the positive effects that coal development and its environmental and social management have on creating jobs and income for Montanans. It is with the promise of such direct and indirect that the orderly and wise development of coal as an energy resource is supported.

U.S. Department of Energy test facility for MHD in Butte. Its task is to test MHD components, which already have operated in laboratories, in a power plant. Also shown, the MHD channel and diffuser in which plasma (ionized gas made from coal) flows at the speed of sound between magnetic poles creating electricity.

Department of Energy photos.



[4] **Data Resources, Inc., Coal Review, May, 1979.**

[5] **Montana University Coal Demand Study Team, "Projections of Northern Great Plains Coal Mining and Energy Conversion Development 1975-2000 A.D., Summary Volume," May, 1976.**

Montana Energy Industries

The efficient use of coal is a major way of alleviating concerns about coal development. In this regard, the MHD research efforts in Montana are especially important because the successful application of this coal conversion technology can increase the energy output per ton of coal mined. The use of waste heat from coal-fired generating plants also can be encouraged. Effective national energy conservation is another strategy that can contribute to the orderliness of the development of Montana coal.

As a consequence of both citizen action and public policy, Montana has been host to substantial renewable energy development efforts. Innovative small-scale hydropower, wind, solar, and bioenergy projects have been undertaken in the state. The initial efforts of the past decade can provide the base for the development of future renewable energy industries in the state. When linked to the forestry and agricultural sectors, such industries could provide a variety of social, economic, and environmental benefits. Similarly, the development of an energy conservation industry can provide some jobs directly and can contribute to other jobs by helping Montana firms take the lead in conserving energy.

Estimates vary, but they predict Montana will produce somewhere between one sixth and one third of the nation's coal supply by the end of the century. Montana Power photo.

The Montana petroleum industry is confronted with a special challenge in the comming decade in the form of a cutoff of Canadian exports of crude oil. Without those exports or an alternative supply of crude oil, the State Department of Natural Resources and Conservation predicts that a shortage of crude oil will occur in this decade. A shortage of crude oil to Montana refineries can produce shortages of and increased costs for refined petroleum products in the state unless a major substitution of alcohol fuels were to occur.

The Northern Tier pipeline is proposed to supply crude oil to, among others, Montana refineries. During the preparation of this report, the pipeline was subject to consideration by local and state governments along its length and by the federal government. Moreover, financial backing for the pipeline remained in the process of being secured. If the Northern Tier pipeline is not constructed, other steps are likely to be necessary to avoid the projected crude oil shortage. Such measures could include an alternative pipeline to deliver Alaskan crude, a major shift to alcohol fuels, intensive energy-conservation measures, the negotiation of increased crude oil exchanges with Canada, or efforts to increase the allocation of crude oil from Montana wells to in-state refineries. The latter measure would involve changes in the historic pattern of marketing of Montana crude oil (a change prohibited by current federal regulations) and a modification of the oil pipeline system within the state.

Energy and Tourism

During 1979, the energy crisis was an unwelcome guest of the Montana tourist economy. Concerns over gasoline supplies and increased prices for fuel contributed to a 23 percent decline in interstate highway travel during the summer tourist season. The economic effect of the 1979 decline in individual vehicle travel is a signal that adjustments in the tourist industry are necessary to respond to changing market conditions.

Some of the adjustments can be undertaken through innovative industry action. The increased marketing of package tours and vacations, the integrated use of different modes of transportation for packaged vacations, experimentation with innovative bus designs from Europe, increased in-state tourism promotion, and the distribution of accurate gasoline-supply information are examples of measures open to the industry itself. Public action can be helpful as well. Federal fuel-economy standards are expected to decrease total fuel consumption by American automobiles more than 25 percent by 1985 and 40 percent by 2000.[6] Several state governments, including Montana, have acted to encourage the development of alcohol fuels, and it appears that the federal government will be following the lead of the states in this area. Montana state government also assists tourism through marketing efforts and through the development of new tourism options, such as packaged tours. The state has also established an incoming WATS line to provide tourists with information on gasoline supply and ski conditions.

[6]Fortune, December 17, 1979, p. 71.

Energy and the Montana Citizen

The differnt forms of energy that are used to satisfy a variety of human needs ideally should possess certain characteristics. The supplies of energy should be adequate, reliable, and sustainable. The production and use of energy should be safe, clean, and efficient. Citizens should be able to afford the amounts of energy that are necessary to serve basic and essential human needs. Securing these and other desirable characteristics is difficult if not impossible because the characteristics are typically in conflict with one another.

One method, among others, of securing adequate supplies of energy and encouraging efficiency in its use is to allow its price to rise. Rising prices, however, can also make it difficult for persons with low or fixed incomes to afford amounts of energy necessary for basic needs. Even methods of conserving energy, such as insulating a home or purchasing a more fuel-efficient automobile, can involve major costs. Thus, those of modest means can find it difficult to afford both the energy they need today and the means of reducing the energy they need tomorrow.

The wholesale price of energy rose by more than 60 percent in 1979, largely as a result of a doubling of the price of imported oil. Nonetheless, the price of petroleum products in the United States remains substantially below what they cost in Western Europe. It also has been argued that these prices are below the cost of substituting other energy sources for the oil that is being depleted. A case can be made that the conservation of non-renewable and diminishing oil resources and the conversion to adequate and acceptable forms of replacement energy requires that prices of current energy rise in an orderly manner to the cost of substitution.

If the burden of rising energy costs is to be borne equitably, measures will be necessary to alleviate the disproportionate impact of that burden on those with low and fixed incomes. Several types of measures are possible. Energy tax and rebate programs can be adopted. The extent of the burden of rising energy costs can be alleviated through research and development of the least costly, acceptable forms of replacement energy. A special category of the latter effort is the research and information program of the National Center for Appropriate Technology. Although its work is aimed at helping low income persons, the technology developed by NCAT can be applied by anyone.

Energy Policy Recommendations

The Council's recommendations are intended to foster balanced economic progress as Montana confronts the energy challenges and opportunities for both effective energy conservation and the orderly development of coal and renewable energy resources in Montana. Measures are recommended also for dealing with special energy conditions confronted by particular groups or industries.

Agriculture and Forestry

Major potential exists for increasing jobs and income in agriculture and forestry through the production of energy from wood wastes and agricultural products. The state's dependence on petroleum products can be reduced through the vigorous development of "biofuels." To encourage the development of alcohol fuels from agricultural products and wood wastes, the following measures should be considered:

1) An expanded, continuing program should be undertaken that involves the demonstration of methods of alcohol fuel production, and the expanded use of alcohol in Montana vehicles, equipment, and industrial processes. Both moderate-sized, area production facilities as well as smaller-scale, on-farm production and storage processes should be promoted.

2) State government should shift its purchases of fuel either partially or completely from gasoline to alcohol-gasoline blends.

3) Depending on prospective assistance from the federal government, the state should expand, on a complementary basis, grant, loan, or loan-guarantee programs for alcohol fuel production. Grant programs, however, should be used exclusively to develop new manufacturing processes.

4) If the federal government proceeds with proposed regional research centers for agricultural and wood energy development, the state should compete vigorously to secure such a center. Efforts to attract such a center might include a pledge to finance joint research projects with the federal government. Clearly the results of all such research and development programs should be publicized. These programs, financed by public funds, should be of maximum benefit to the public at large.

The development of other forms of energy from wood wastes and noncommercial timber also should be encouraged. Measures to be considered for that purpose include:

1) Research into techniques of wood energy production in Montana, including methods of burning wood more efficiently with little or no air pollution, methods of pyrolysis to produce char, oil or gas, and methods of pelletizing and marketing wood. The increased application of wood energy in industrial processes and electrical generation also should be studied through such a program.

2) Any grant, loan, or loan-guarantee program for alcohol fuel production should be applicable to wood energy production facilities as well.

3) As discussed in greater detail in the Council's report last year, the supply of timber in the state should be enhanced through intensive management of the most productive timber sites. Intensive management includes thinning and the removal of salvage material from the forest. Such materials could be beneficially used in wood energy facilities. In addition, estimates of timber resources should be modified to include an assessment of the material suitable for energy use.

It is very important that the tax structure reflect the potential of forest land under an intensive management program. With the

proper incentive and tax considerations, production of wood fiber easily can be doubled. The taxing formula should be correlated to the timber production plan and should take into consideration the cost of carrying young stands of trees to commercial size.

Although agriculture is not as energy intensive as other sectors of the economy, the timing of adequate supplies of energy is critical to agricultural production. To promote the availability of properly timed energy supplies to agriculture, the following should be considered:

Photos by State Travel Promotion Unit.

1) Expansion of local or on-farm storage and production of alcohol fuels as a reserve for peak-season use;

2) Expanded activities related to energy conservation in agriculture, including grants for on-farm demonstration of conservation techniques; and

3) Continued fuel allocation priorities for agriculture during seasonal periods of shortages.

The Council noted with concern in its first report the conflict between agriculture and subdivisions for the use of land. It is noted here that the energy impact of suburban development of agricultural land can be negative. The conversion of prime agricultural land to nonagricultural uses has been accompanied by the conversion of less desirable lands to crop use. These less desirable lands often require greater energy use in the form of additional fertilizer to achieve an acceptable level of production. In addition, depending on their location, subdivisions also can increase energy use for commuting. This latter topic is considered in this report under the section, "Residential and Local Government Conservation." With respect to the loss of prime agricultural land, consideration should be given to:

1) A state requirement that local governments consider the preservation of their best agricultural lands in the adoption of their local comprehensive plans; and

2) Examination by the state of innovative methods used in other states and communities to preserve prime agricultural lands.

Manufacturing, Mining, and Energy

As energy prices increase, the efficiency of the use of energy within Montana industry will become an increasingly important factor in its competitive position relative to industry in other states. Maintaining that competitive position is important to both safeguard and enhance jobs and income in the state, and for that purpose the following measures should be considered:

1) Supplies of petroleum products and electricity better could be insured for industrial processes that require them by reducing the use of these forms of energy for other purposes such as home heating and automobile travel. Energy use can be reduced for these non-industrial purposes through effective energy conservation and partial conversion to renewable energy sources.

2) Incentives should be adopted to encourage increased industrial energy efficiency, the cogeneration of heat and power, and conversion from oil-based energy to renewable or coal energy on an environmentally-acceptable basis.

3) Utility regulation laws and practicies should be studied to determine obstacles to the cogeneration of heat and power; appropriate measures should be adopted to remove such obstacles.

4) State technical assistance to the mining industry should be expanded to include increased attention to the reduction of energy use in mining operations.

The Council stated in its first report its support for encouraging the orderly development of the state's coal resource in accordance with Montana law. The development of coal will continue to be a source of significant future jobs within the state. To promote the efficient use of this coal resource, coal conversion facilities planned in the future should be required to consider the use of the MHD process and the use of waste heat for beneficial purposes during the planning phases of such facilities. To ensure that the development of coal is, in fact, orderly and consistent with the full range of goals recommended by the Council, the state should continue its study and monitoring of coal use in the state, with a priority on air pollution studies. Research also should be encouraged in improved methods of coal development and conversion, including ways of improving the cost-to-benefit ratio of present mining techniques.

The commercialization of wind and solar power in the state should be encouraged. The commercialization of proven technologies can be facilitated through state loans and loan guarantees. Similar incentives can be provided for the development of private-sector energy-advisory services to serve energy users.

The state approach to the development of new and expanded manufacturing enterprises has been tailored to an era of energy and other resource constraints. One emphasis in this approach has been the encouragement of enterprises that export from the state products with a high value-to-weight ratio. Such enterprises typically have a relatively low use of transportation and energy in relation to the value of their output. Another emphasis is the development of enterprises that make products which have previously been imported from outside the state, for the Montana market. These enterprises, such as meat packing, can eliminate many of the energy and transportation costs associated with importing a type of product from out-of-state. This approach to manufacturing development should continue and be intensified. In a similar vein, development should be encouraged in Montana of mineral resources such as vermiculite for the insulation industry and phosphate for agricultural fertilizer, adding as much value as possible to the products prior to shipment.

Photo by Doug O'looney.

Residential and Local Government Conservation

The conservation of energy by residential, commercial, and governmental users is important to help ensure adequate supplies of petroleum products and electricity for specialized industrial and agricultural processes. In addition, conservation will be important to saving the dollars of taxpayers and consumers. Conservation can be encouraged through the following measures:

1) Local governments might be required to adopt and might be empowered to implement local community energy-conservation and renewable-energy use plans.

2) Research and development should be conducted for converting municipal wastes into useable energy.

3) Local subdivisions should be reviewed from the standpoint of their energy impact.

4) Encouragement should be given to expanded use by utilities, banks, and citizens of favorable loan programs for energy conservation and alternative energy use in residences. Such loans were provided special tax incentives by the 1979 Legislature.

5) State government should review building codes and development regulations for the purpose of identifying changes that would encourage energy conservation and renewable energy development.

In addition to conservation measures, the state should pay special attention to the energy-related needs of the elderly and other persons with fixed and limited incomes.

Tourism

The impact of petroleum supply and price conditions on tourism can be moderated and even prevented by imaginative action by both the industry and state government. The vigorous development of gasoline-alcohol fuel blends by Montana and other rural states should ease motor fuel supply conditions in the mid-term future. The state's tourism program has adjusted in a variety of ways to changing energy and economic conditions. Advertising has been focused on regional instead of national markets and on the international traveler who is attracted to the United States because of favorable exchange rates. Package tours have been developed, and the reasonable cost of travel in Montana is being stressed in advertising.

To further assist the tourism industry in responding to energy conditions, the following should be considered:

1) The state's tourism promotion and development program might be expanded on a basis similar to certain agricultural research and marketing programs that are funded through a "checkoff" on the product of the industry being assisted. A tourism industry tax should be considered to finance increased state tourism efforts.

2) Innovative tourism advertising and package tour development should be expanded. This should include ranch and farm vacations, to be promoted both within and outside the state.

3) Aggressive efforts should be planned to promote in-state tourism. Programs should be developed that show Montanans the many, varied scenic beauties and recreational opportunities in all areas of Montana, especially less publicized places.

4) Expanded promotion should be undertaken to inform out-of-state visitors of small-town events and cultural activities, and to encourage them to visit "out-of-the-way Montana."

5) Research could be conducted into the innovative and coordinated use of air, rail, motorcoach, and auto transportation by the visitor to the state. On the basis of such research, encouragement should be given to the development of improved tourism transportation in Montana.

Concluding Note

Measures relating to the conservation of energy in transportation are given consideration in the following section of this report. This section has considered changing energy conditions and their impact on the Montana economy. Recommendations have been made that would continue the orderly development of coal in Montana, that would encourage the expansion of renewable energy production and the development of energy conservation businesses, and that generally would increase energy efficiency in Montana and help to gurantee critical energy supplies to major Montana industries. At any given time, state government is limited in what it can do to affect immediate economic conditions. It can, however, chart a longer term course that can foster the achievement of beneficial public goals.

Transportation and the Montana Economy

The central feature of Montana's basic commodity freight system—its railroads and highways—is that current levels of public and private revenues are insufficient to prevent its deterioration. Between 1968 and 1978, the increase in highway revenues was only about one-half of the increase in the highway construction price index. No price index is available for highway maintenance costs, and the state expenditures for highway maintenance tend to follow revenue trends closely.

Although the 1979 Legislature increased the state gasoline tax by 1¢ per gallon, that increase was intended primarily for the completion of the interstate system and was not sufficient to compensate for the decline in gallons of gasoline used on Montana roads the past year. As the fuel efficiency of automobiles increases dramatically during the 1980s, lagging highway revenues are likely to continue even if the number of vehicle miles traveled increases. Unless additional revenues are secured, the prospect is for a deterioration in the state's highway system in the next decade or two.

For the railroads, the rates of return on lines in rural states are generally not as high as in densely settled urban areas. In addition, operating costs in a northern state such as Montana are relatively high because of winter snow conditions. Lower rates of return in northern, rural states mean that even if a railroad earns a profit in a state, it may invest its railbed maintenance and improvement funds in other areas with a higher rate of return. A failure to reinvest in railbeds typically leads to a decline in rail service with a cumulative decline in profits on the affected lines, leading eventually to the abandonment of selected lines or the bankruptcy of a railroad.

The bankruptcy of the Milwaukee Road continued to be the state's major railroad problem during 1979, and the outcome of this crisis remained in doubt as this report was prepared. The threatened loss of competitive rail freight service in Montana is likely to create serious economic and energy impacts. Net export earnings would suffer, highways would bear new freight burdens, energy usage would increase as trucks are substituted for rail cars, and a rail monopoly would be created. A major infusion of private investment as well as federal assistance is necessary if competitive Milwaukee service is to be retained.

The cost of rail service is another major concern. Studies at Montana State University suggest that 50-car unit trains for the shipment of grain would produce major cost savings over and above the cost of building subterminal and elevator storage necessary for the operation of such trains.[7] The unit train concept carries with it prospects for change in the structure of the local elevator industry, but insufficient study has been made of what these changes and their implications might be. Further studies of alternative methods of bulk commodity shipment and regional grain shipment facilities also are being sponsored by the rail planning unit in the Department of Highways.

Airline deregulation has brought increased change in air service in Montana. Both increases and decreases in service occur on a more frequent basis because of the increased influence of market forces. Commuter air service has expanded, and the future of such "third tier" air carriers will determine the future availability of air service to many smaller Montana communities.

Overall, the major determinants of the future of the state's basic transportation system are federal policy and national and international economic forces. Greater state influence on the future of transportation in Montana would require a modification of the state's role concerning these systems.

[7]**Won W. Koo and Thomas P. Drinka, "Alternatives for Future Rail Grain Transportation in Montana," April, 1979.**

Transportation Policy Recommendations

Increased state influence on Montana's transportation system would come at the price of greater state participation in its financing. If an increased effort by the state to maintain the quality and extent of the transportation system is desired, the following measures should be considered:

1) The state gasoline tax could be increased progressively to counter lagging revenues that will occur as vehicles become more fuel efficient. The tax also could produce some energy conservation effects of its own as its level increased. an additional five percent tax based on the retail price is recommended, the proceeds earmarked for highway construction and maintenance.

2) In the context of the continuing changes created by federal airline deregulation, the state should increase its efforts to protect the air transportation interests of the state. Particular emphasis should be placed on developing in-state air service.

3) State government activity should be expanded in the economics and technology of transportation, and increased federal transportation research funds should be sought for the state.

4) State activities should be undertaken to promote the use of advanced communications as a means of linking persons in remote communities with larger communities.

5) In recognition of the need for enhanced public trucking services in the state, methods should be examined by state government for the improvement of this transportation service.

6) Montana and its neighboring states should foster expanded development of West Coast port facilities serving the region and develop ways of maximizing the use of existing storage facilities.

The conservation of petroleum energy in transportation can be achieved through the increased use of alcohol fuel blends, innovative community planning, and the further development of urban transit systems.

Energy and transportation trends will interact in complex ways in the next two decades, and the consequences cannot be precisely foreseen. In 1970, the idea of plants being developed to produce alcohol fuels in Montana would have been considered a remote possiblity. Before the end of this new decade, the production of electric cars, at least for city use, will resume in the United States. Energy planning for the major communities in Montana should begin to consider the possible impact of this prospective change in automobile transportation on the demand for electricity. Moreover, given Montana's potential to produce electricity from hydropower, coal, wood, and cogeneration sources, the possibility of developing enterprises related to the operation of electrical vehicles should not be overlooked.

Changing energy conditions also are likely to produce changes in the technology of freight transport—ranging from equipment changes for more efficient truck and rail transport to the development of new methods of shipping freight. The recommendation made above concerning transportation research is important if Montana is to secure timely information about such changes in transportation methods early in Montana.

International Export Trade

Montana's major international exports are agricultural products. More than one-third of Montana's agricultural output was exported from the country in 1976, and the state's agricultural exports grew by more than 218 percent between 1972 and 1976—faster than the national average increase of 198 percent.[8] The value of these farm exports was $322 million. By comparison, manufactured exports from Montana to foreign nations totaled $44 million in 1976—about 2 percent of the state's manufactured output. Manufactured food products and lumber products were the major exports in this category.

Future prospects for increased exports include the possibility of coal and other agricultural and mineral commodity exports to foreign markets and continued increases in specialized manufactured items. The future of all American agricultural exports has been clouded by the partial grain embargo imposed against the Soviet Union in retaliation for its invasion of Afghanistan. Although efforts to market agricultural products elsewhere can and should intensify, the prospect of the loss of future export sales to the Soviet Union has major implications for the Montana agricultural economy. The response to the Soviet situation appropriately would be an intensification of all other international trade efforts by the state.

[8]All trade data from U.S. Department of Commerce, Montana Exports, State Export Series, 1978.

International Trade Recommendations

The general intensification of state international trade efforts should involve a coordinated strategy of detailed market research, product and enterprise development, product marketing, and transportation development. Steps to implement such a strategy should include:

1) Establishment of a state capability to identify markets, preferably of a specialized character, that can be served by products made in Montana;

2) Expansion of the state's promotional activities related to major current and prospective industries in Montana;

3) Attraction of private industry assistance to complement publicly supported development activity related to Montana industries;

4) Continued and expanded efforts to encourage the establishment of local-development corporations to assist with the development of new enterprises, many of which are likely to produce for export;

5) Development of public and/or private venture capital assistance for the encouragement of firms to produce for export markets;

6) Increased technical assistance to farmers and commodity groups on the production of agricultural products suitable for identified export markets;

7) Expansion of state and regional trade-relations efforts, including the creation of a western-states international-trade commission to sell western products in greater volume to foreign markets; and

8) Implementation of an expanded state role in the development and maintenance of transportation systems.

Paramount to the development of Montana's international trade program is the need to expand the industrial development activities of state government, and to do so with the full cooperation of the private sector. In a state that has suffered perenially from capital scarcity, new businesses spring up, wither, and die largely because ownership capital and sufficient credit are unavailable. It is recommended and urged that state government—both the legislative and executive—determine appropriate remedies for this deficiency. Capital must be put in the hands of Montanans capable of creating jobs and developing products for export. This can be accomplished most effectively by tapping the considerable expertise of the state's financial community. Tax reductions and abatements in parallel to those adopted by the federal government—accelerated depreciation, graduated taxes—should be enacted to encourage the formation of exporting businesses. Without a diversified, vital base of exporting businesses, the other recommendations contained in this report are of little consequence. The jobs created by these businesses form the productive core of the Montana economy. Their exports cause a constant flow of dollars into the state. Without this flow, Montana could not maintain an economy. And if this flow of dollars loses force, all other economic and political activity deteriorates.

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